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Watanabe et al.

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(54) **METAL WIRING PLATE**

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H01L 23/34 (2006.01)

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(58) **Field of Classification Search** 174/255, 174/261, 267, 260, 526, 546, 547, 548; 361/799, 361/800, 752–759
See application file for complete search history.

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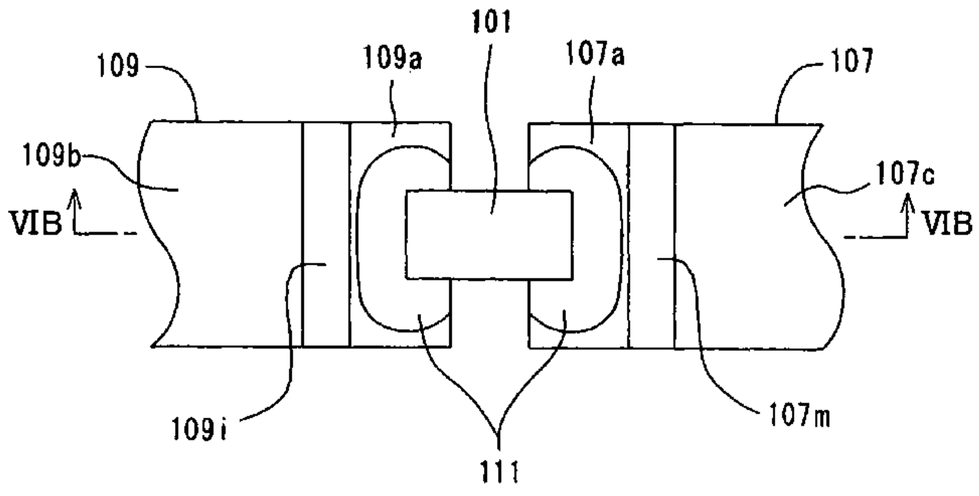
(57) **ABSTRACT**

A metal wiring plate includes a soldering portion to which an electronic device is soldered and a wiring portion extending from the soldering portion and configured to electrically connect the electronic device to other device. The wiring portion includes a narrow portion located adjacent to the soldering portion. The width of the narrow portion is less than the width of the soldering portion so that the narrow portion helps prevent melted solder applied to the soldering portion from spreading to areas outside the soldering portion. The narrow portion allows the electronic apparatus to be surely soldered to the soldering portion without using solder resist.

8 Claims, 5 Drawing Sheets



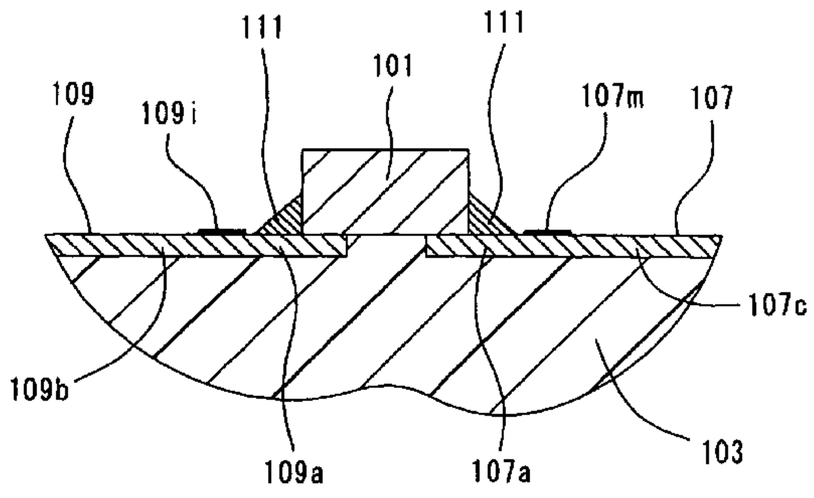


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FIG. 1

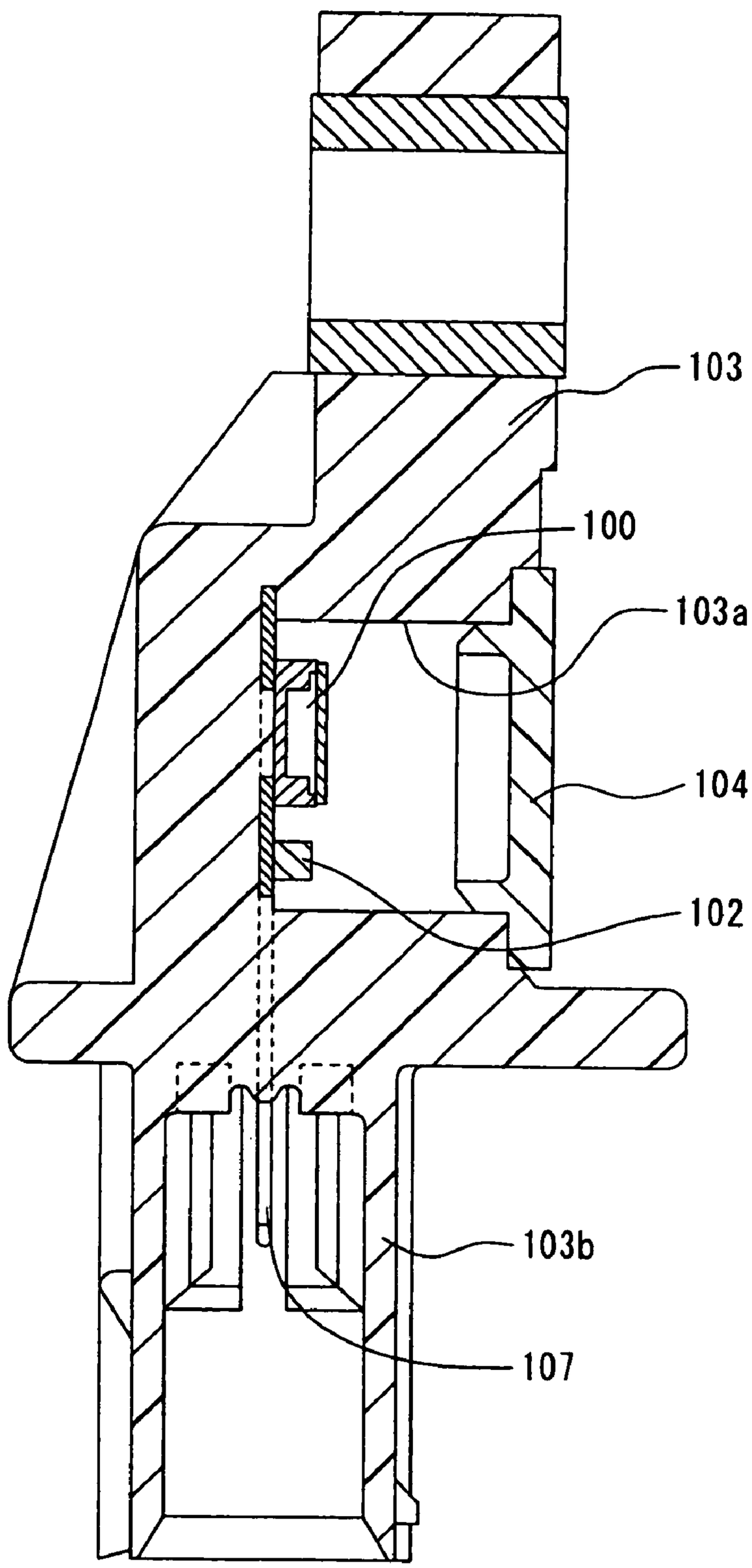


FIG. 2

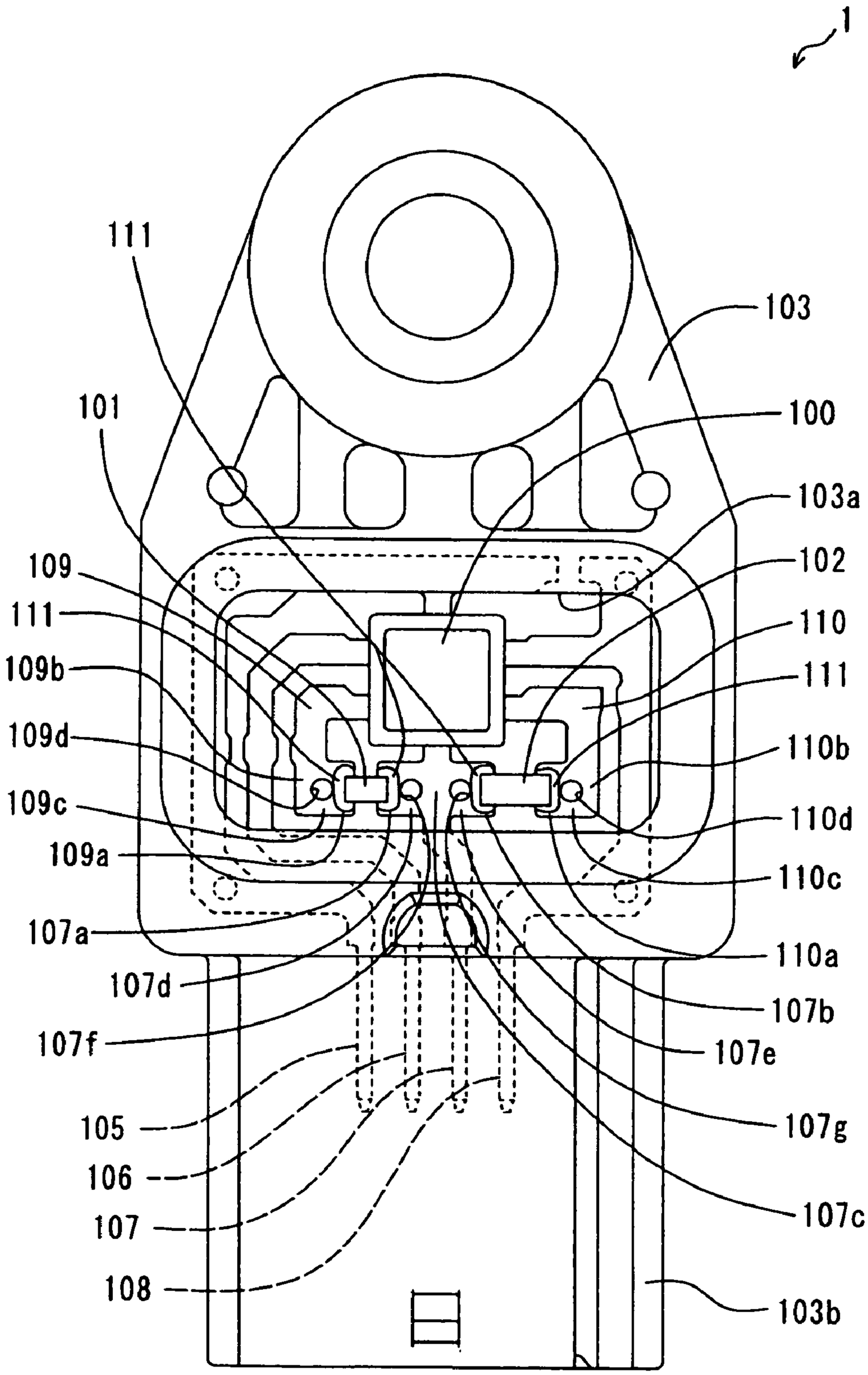

1
111
103
101
100
103a
109
102
111
110
109b
111
109d
110b
109c
110d
109a
110c
110a
107a
107d
107b
107f
107e
105
107g
106
107c
107
108
103b

FIG. 3

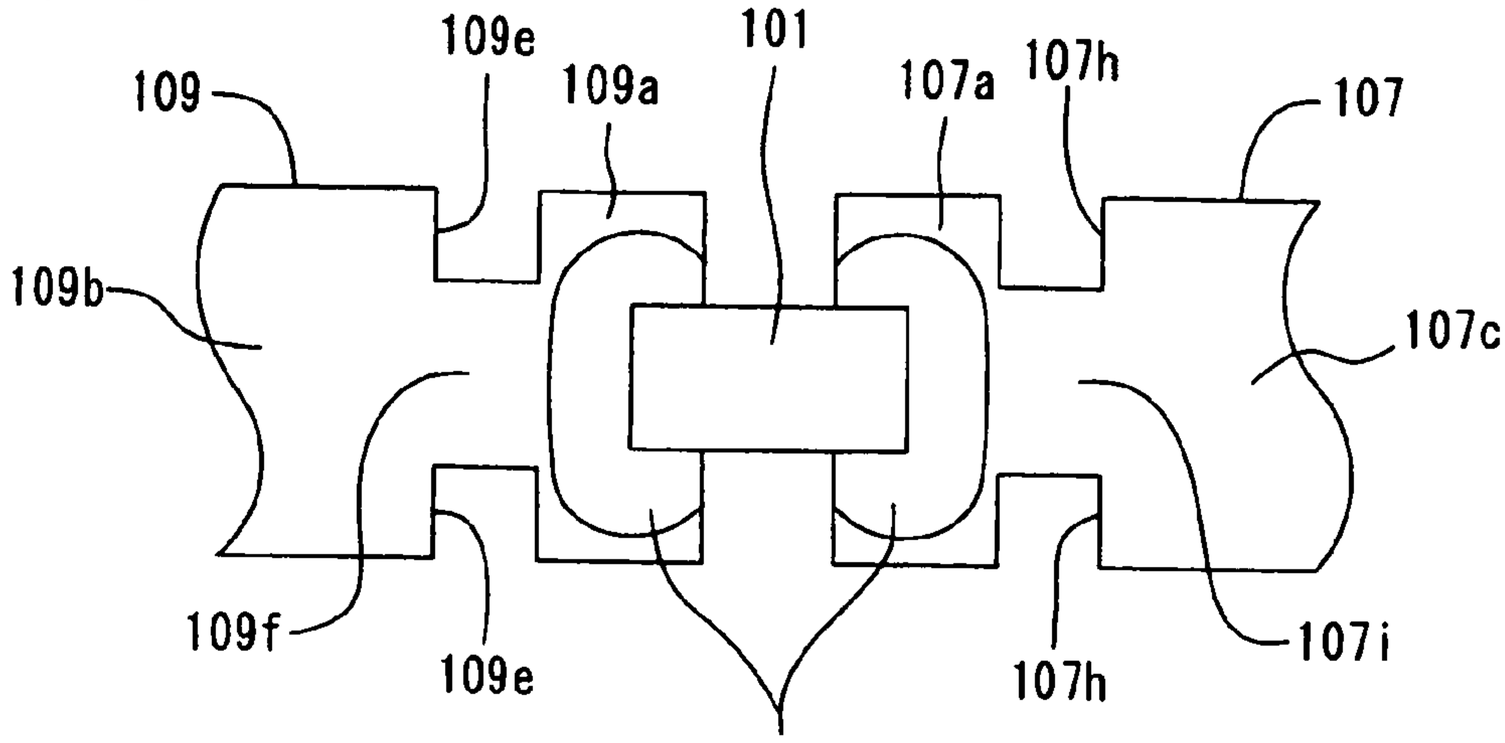


FIG. 4A

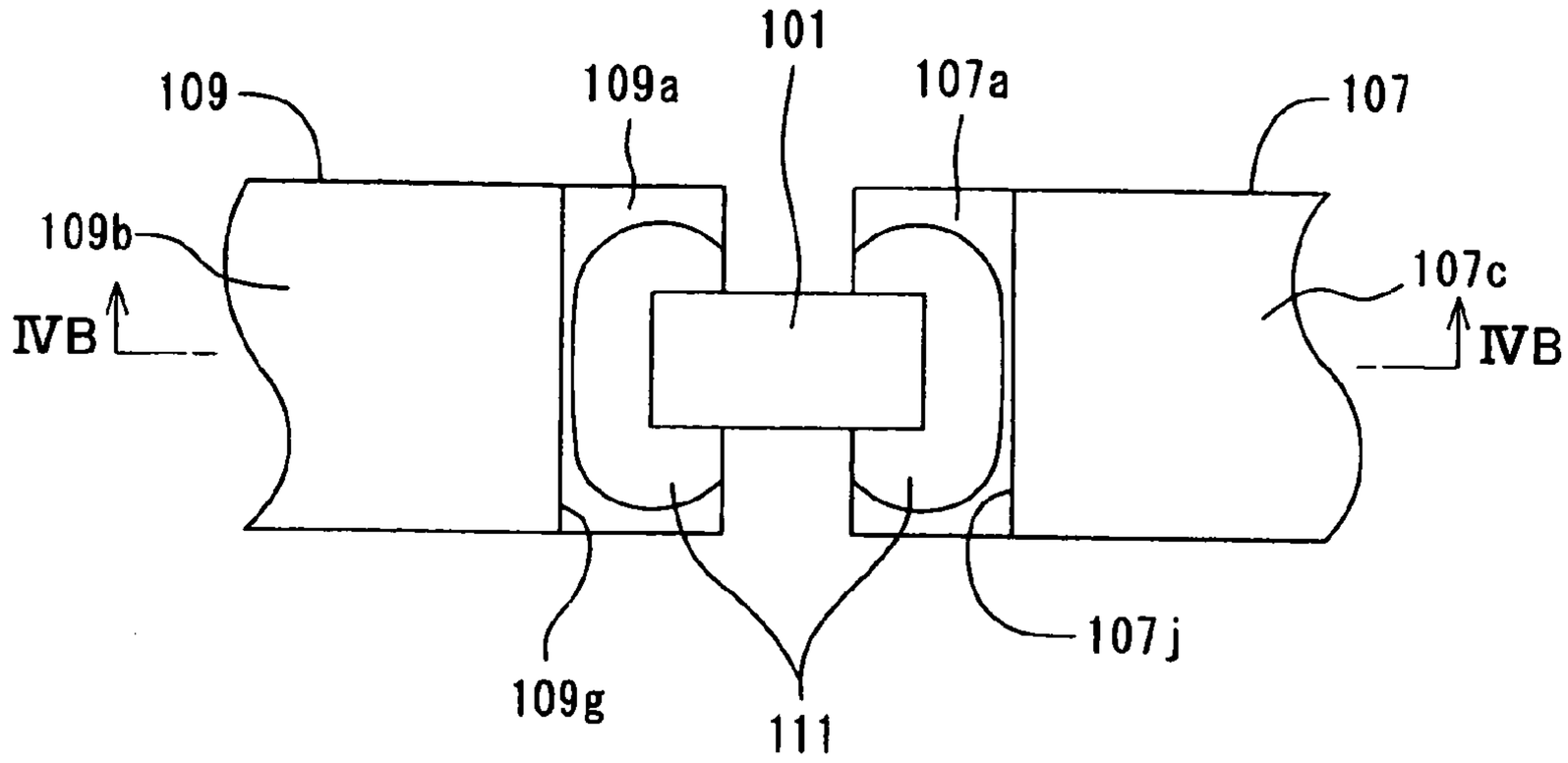


FIG. 4B

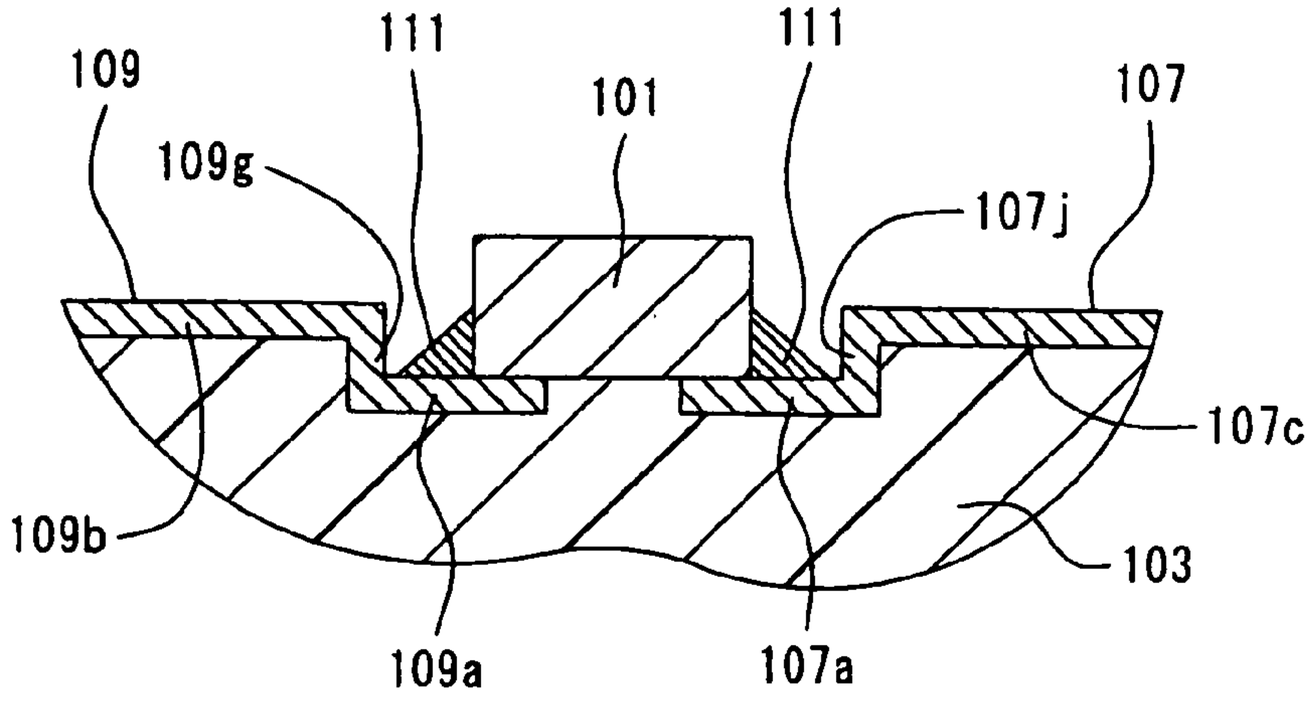


FIG. 5A

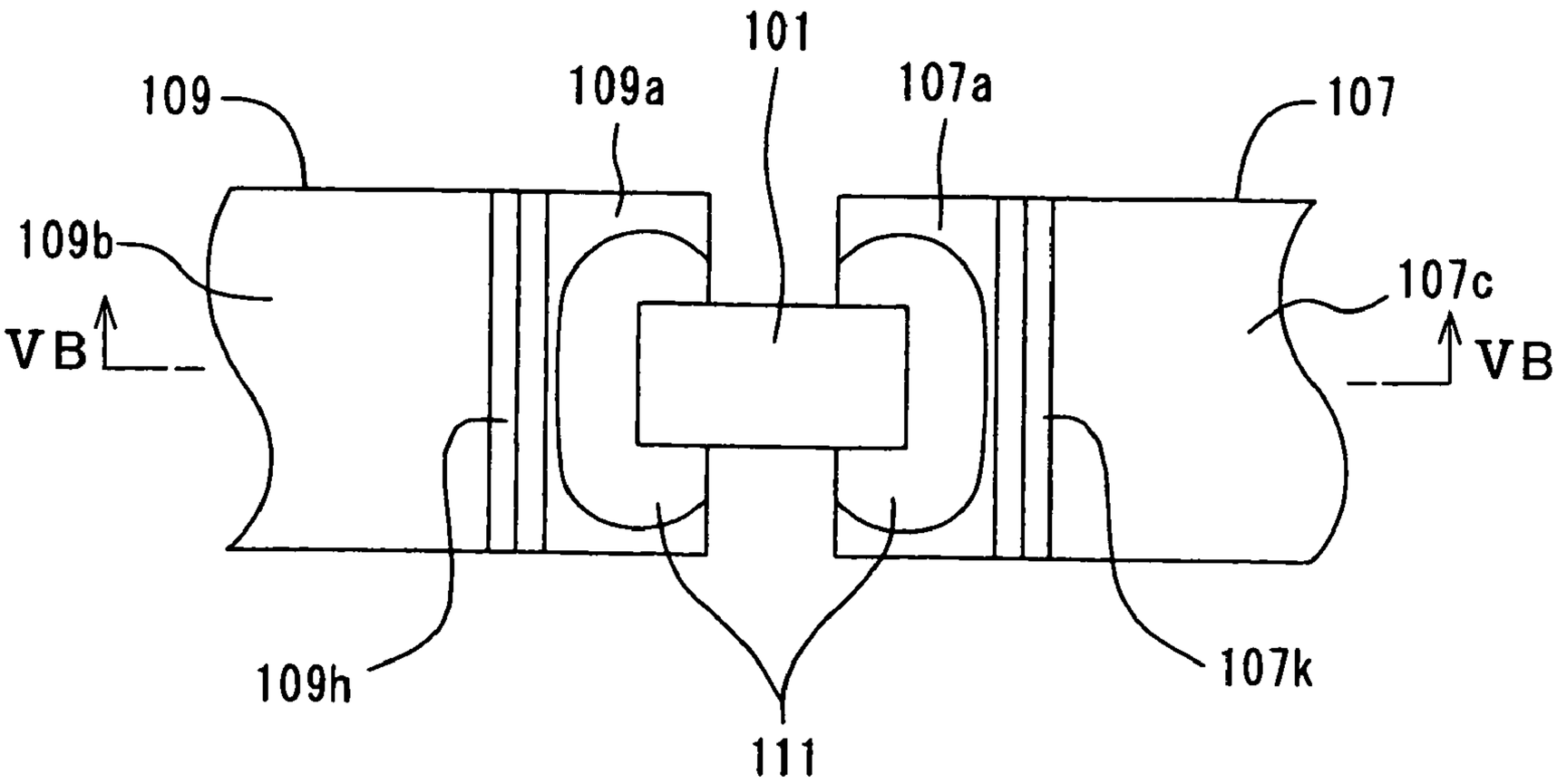

101
109
109a
107a
107
109b
107c
VB
VB
109h
107k
111

FIG. 5B

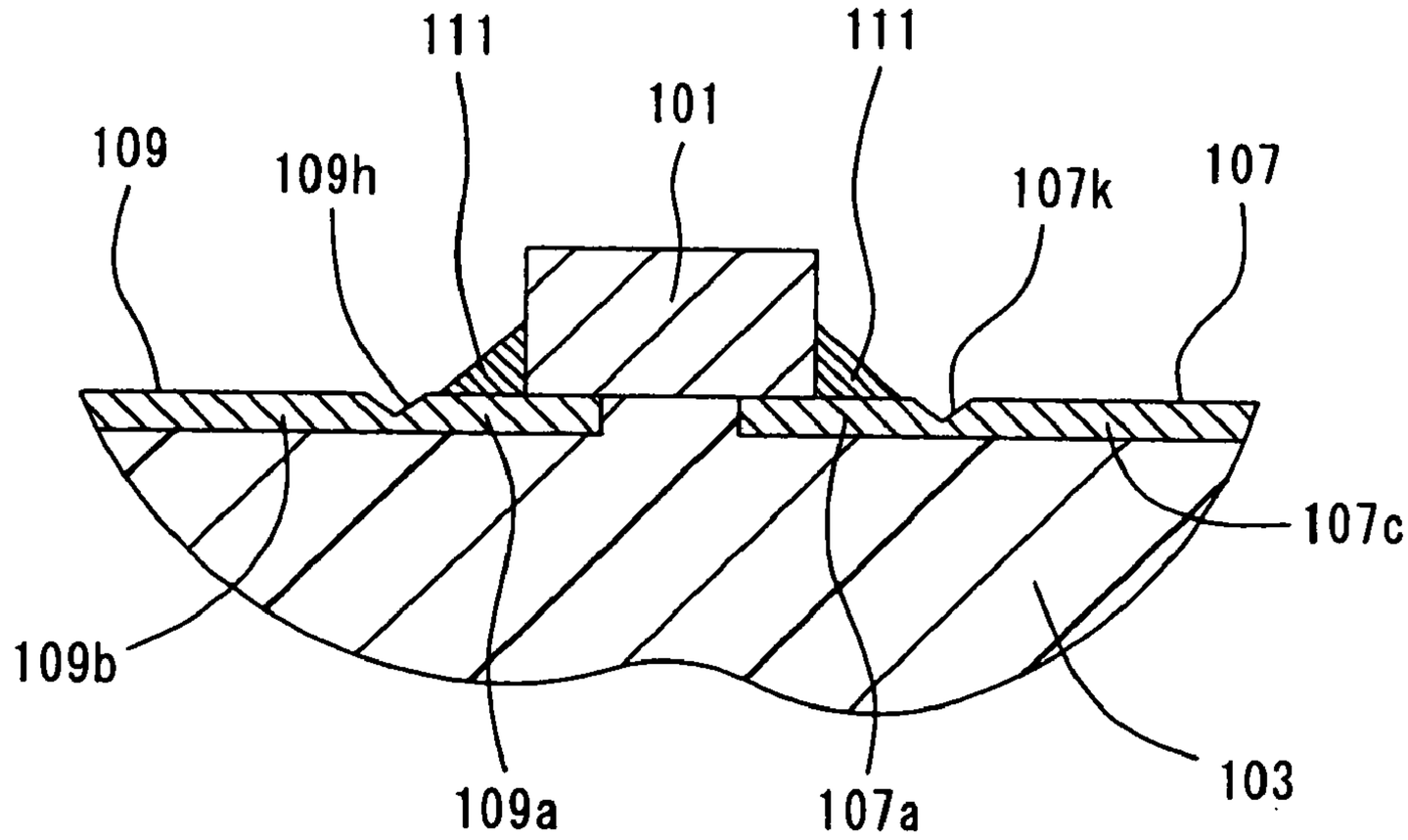

111
111
101
109
109h
107k
107
107c
109b
109a
107a
103

FIG. 6A

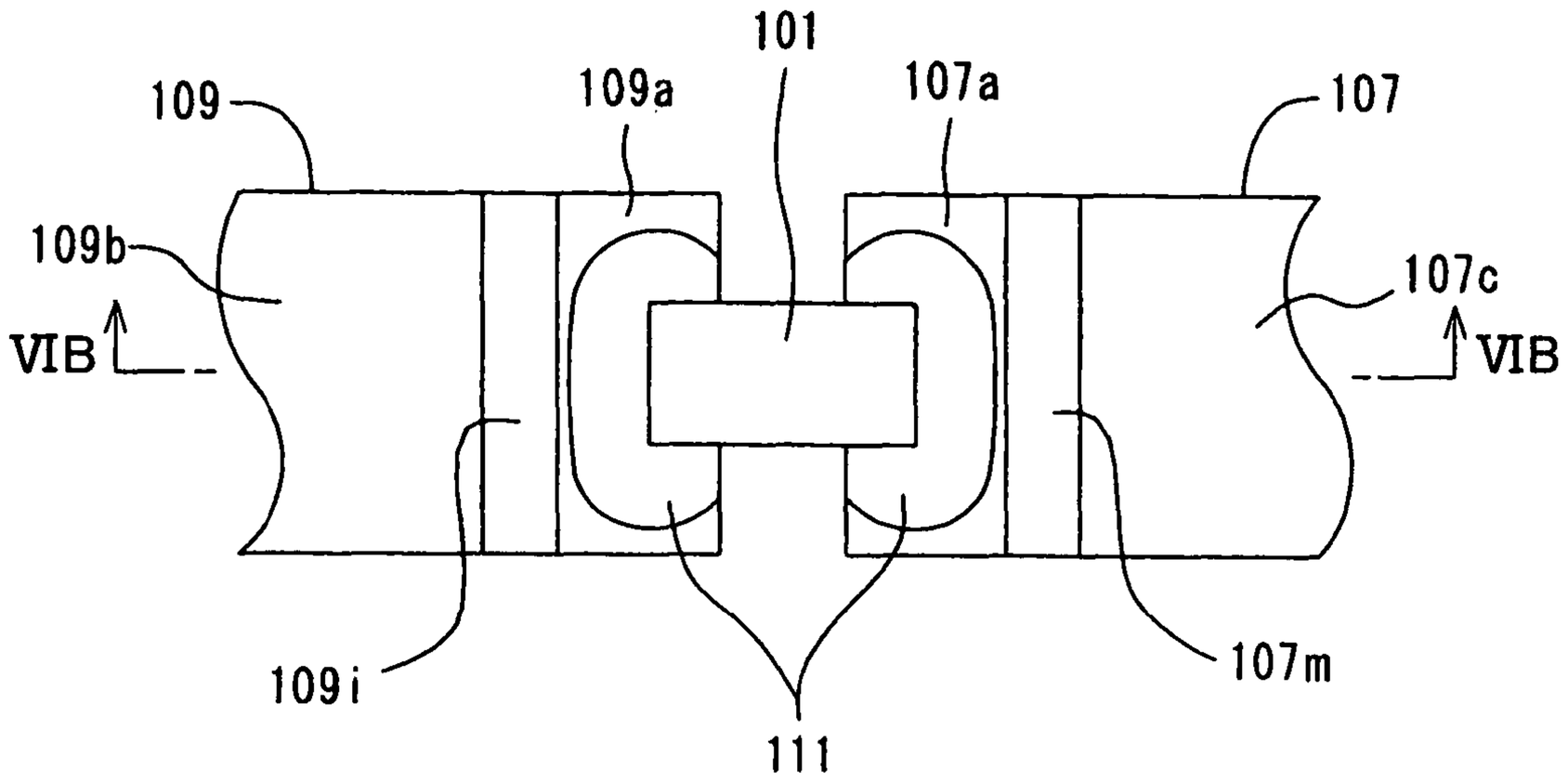
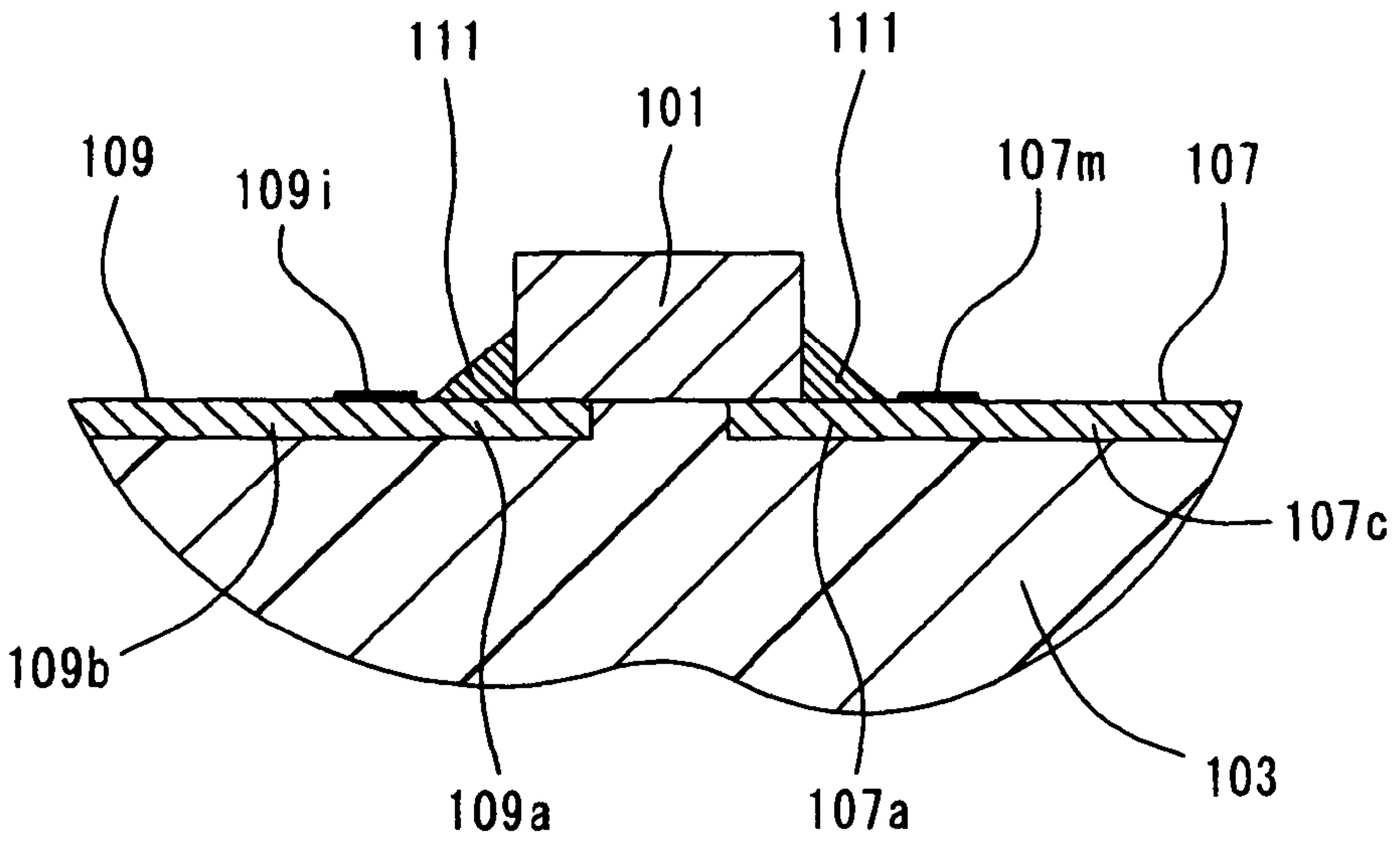

101
109
109a
107a
107
109b
107c
VIB
VIB
109i
107m
111

FIG. 6B


111
111
101
109
109i
107m
107
107c
109b
103
109a
107a

METAL WIRING PLATE

CROSS REFERENCE TO RELATED APPLICATION

This application is based on and incorporates herein by reference Japanese Patent Application No. 2007-115902 filed on Apr. 25, 2007.

FIELD OF THE INVENTION

The present invention relates to a metal wiring plate for electrically connecting an electronic device to other device through solder.

BACKGROUND OF THE INVENTION

US 20040119155A1 corresponding to JP-A-2004-200464 discloses a metal wiring plate for electrically connecting an electronic device to other device through solder. The metal wiring plate is a cluster of wiring portions arranged and held in a predetermined wiring pattern. The wiring portion has a soldering portion to which an electronic device is soldered. When melted solder applied to the soldering portion spreads to areas outside the soldering portion, a suitable solder fillet is not formed at the soldering portion. As a result, the electronic component cannot be surely soldered to the metal wiring plate. To prevent this program, the areas outside the soldering portion are coated with solder resist. However, the solder resist coating needs a printing process, which increases manufacturing cost of the metal wiring plate.

SUMMARY OF THE INVENTION

In view of the above-described problem, it is an object of the present invention to provide a metal wiring plate to which an electronic device can be surely soldered without using solder resist.

According to a first aspect of the present invention, a metal wiring plate includes a soldering portion and a wiring portion. An electronic device is soldered to the soldering portion. The wiring portion extends from the soldering portion and is configured to electrically connect the electronic device to other device. The wiring portion includes a narrow portion located adjacent to the soldering portion. The width of the narrow portion is less than the width of the soldering portion.

According to a second aspect of the present invention, a metal wiring plate includes a soldering portion and a wiring portion. An electronic device is soldered to the soldering portion. The wiring portion extends from the soldering portion and is configured to electrically connect the electronic device to other device. The wiring portion includes a wall portion located adjacent to the soldering portion. The wall portion extends upward from the soldering portion and causes the wiring portion to be located at a higher elevation than the soldering portion.

According to a third aspect of the present invention, a metal wiring plate includes a soldering portion and a wiring portion. An electronic device is soldered to the soldering portion. The wiring portion extends from the soldering portion and is configured to electrically connect the electronic device to other device. The wiring portion includes a groove portion located adjacent to the soldering portion.

According to a fourth aspect of the present invention, a metal wiring plate includes a soldering portion and a wiring portion. An electronic device is soldered to the soldering portion. The wiring portion extends from the soldering portion and is configured to electrically connect the electronic device to other device. The wiring portion includes a plated layer on a surface located adjacent to the soldering portion. The plated layer is made of a material having a less solder wettability than a material of which the soldering portion is made.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objectives, features and advantages of the present invention will become more apparent from the following detailed description made with check to the accompanying drawings. In the drawings:

FIG. **1** is a diagram illustrating a cross sectional view of an acceleration sensor apparatus according to a first embodiment of the present invention;

FIG. **2** is a diagram illustrating a back view of the acceleration sensor apparatus of FIG. **1**, a lid of which is detached therefrom;

FIG. **3** is a diagram illustrating a partially enlarged view of an acceleration sensor apparatus according to a modification of the first embodiment;

FIG. **4**A is a diagram illustrating a partially enlarged view of an acceleration sensor apparatus according to a second embodiment of the present invention, and FIG. **4**B is a diagram illustrating a cross-sectional view taken along line IVB-IVB of FIG. **4**A;

FIG. **5**A is a diagram illustrating a partially enlarged view of an acceleration sensor apparatus according to a third embodiment of the present invention, and FIG. **5**B is a diagram illustrating a cross-sectional view taken along line VB-VB of FIG. **5**A; and

FIG. **6**A is a diagram illustrating a partially enlarged view of an acceleration sensor apparatus according to a fourth embodiment of the present invention, and FIG. **6**B is a diagram illustrating a cross-sectional view taken along line VIB-VIB of FIG. **6**A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

Referring to FIGS. **1** and **2**, an acceleration sensor apparatus **1** according to a first embodiment of the present invention includes an acceleration sensing device **100**, capacitors **101**, **102**, a housing **103**, a lid **104**, connector terminals **105-108**, and terminals **109**, **110**.

The sensing device **100** detects acceleration and outputs a sensor signal corresponding to the detected acceleration. The sensing device **100** is a semiconductor sensor chip housed in a package such as a ceramic package. The capacitors **101**, **102** allow the sensing device **100** to operate. The sensing device **100** and the capacitors **101**, **102** construct an electronic circuit.

The housing **103** is made of resin and has a recess **103***a* with an opening. The sensing device **100** and the capacitors **101**, **102** are housed in the recess **103***a*. The lid **104** is made of resin and covers the opening of the recess **103***a*. Thus, the recess **103***a* is sealed by the lid **104** so that the sensing device **100** and the capacitors **101**, **102** can be protected from damage such as water, dust, or the like.

Each of the connector terminals **105-108** is a metal plate formed in a predetermined shape and electronically connects the sensing device **100** and an external apparatus. Further, the connector terminal **107** electrically connects the sensing device **100** and the capacitors **101**, **102**.

The connector terminal **107**, which serves as a metal wiring plate, has a soldering portion **107***a*, **107***b* and a wiring portion **107***c*. The soldering portion **107***a*, **107***b* are located approximately in the middle of the connector terminal **107**. First edge portions of the capacitors **101**, **102** are soldered to the soldering portions **107***a*, **107***b* of the connector terminal **107**, respectively. The wiring portion **107***c* is located between the soldering portions **107***a*, **107***b*, and the capacitors **101**, **102** soldered to the soldering portions **107***a*, **107***b* are connected through the wiring portion **107***c*. Thus, the wiring portion **107***c* serves as an electric wire. The wiring portion **107***c* has a circular through hole **107***f* near the soldering portion **107***a* and has a circular through hole **107***g* near the soldering portion **107***b*. The circular through hole **107***f* forms a narrow portion **107***d* that is located adjacent to the soldering portion **107***a* and has a width less than that of the soldering portion **107***a*. Likewise, the circular through hole **107***g* forms a narrow portion **107***e* that is located adjacent to the soldering portion **107***b* and has a width less than that of the soldering portion **107***b*. Therefore, the narrow portions **107***d*, **107***e* and the connector terminal **107** are one-piece.

Each of the terminals **109**, **110** is a metal plate formed in a predetermined shape and electronically connects the sensing device **100** and the capacitors **101**, **102**. The terminal **109**, which serves as a metal wiring plate, has a soldering portion **109***a* and a wiring portion **109***b*. The soldering portion **109***a* is located at a first end of the terminal **109**. A second edge portion of the capacitor **101** is soldered to the soldering portion **109***a*. The wiring portion **109***b* extends from the soldering portion **109***a* and provides an electrical connection between the capacitor **101** soldered to the soldering portion **109***a* and the sensing device **100**. The wiring portion **109***b* has a circular through hole **109***d* near the soldering portion **109***a*. The circular through hole **109***d* forms a narrow portion **109***c* that is located adjacent to the soldering portion **109***a* and has a width less than that of the soldering portion **109***a*. The terminal **110**, which serves as a metal wiring plate, has a soldering portion **110***a* and a wiring portion **110***b*. The soldering portion **110***a* is located at a first end of the terminal **110**. A second edge portion of the capacitor **102** is soldered to the soldering portion **110***a*. The wiring portion **110***b* extends from the soldering portion **110***a* and provides an electrical connection between the capacitor **102** soldered to the soldering portion **110***a* and the sensing device **100**. The wiring portion **110***b* has a circular through hole **110***d* near the soldering portion **110***a*. The circular through hole **110***d* forms a narrow portion **110***c* that is located adjacent to the soldering portion **110***a* and has a width less than that of the soldering portion **110***a*.

The connector terminals **105-108** are integrally fixed to the housing **103**. Each of the connector terminals **105-108** has a first end exposed outside the housing **103** and a second end exposed to the recess **103***a* of the housing **103**. The terminals **109**, **110** are integrally fixed to the housing **103**. A connector housing **103***b* is integrally formed with the housing **103** to surround the first ends of the connector terminals **105-108**. The second ends of the connector terminals **105-108** and the terminals **109**, **110** are located in the recess **103***a*. Each of the second ends of the connector terminals **105-108** and the terminals **109**, **110** has a front side exposed to the inside of the recess **103***a* and a back side fixed to a bottom of the recess **103***a*. The sensing device **100** is soldered to the second ends of the connector terminals **105-108** and second ends of the terminals **109**, **110**. The capacitor **101** is soldered to the soldering portion **107***a* of the connector terminal **107** and the soldering portion **109***a* of the terminal **109** through solder **111**. The capacitor **102** is soldered to the soldering portion **107***b* of the connector terminal **107** and the soldering portion **109***b* of the terminal **109** through solder **111**. The opening of the recess **103***a*, where the sensing device **100** and the capacitors **101**, **102** are accommodated, is covered with the lid **104** so that the recess **103***a* can be sealed.

According to the first embodiment, the narrow portions **107***d*, **107***e*, **109***c*, **110***c* are located adjacent to the soldering portions **107***a*, **107***b*, **109***a*, **110***a*, respectively. The narrow portions **107***d*, **107***e*, **109***c*, **110***c* help prevent melted solder **111** from spreading to areas outside the soldering portions **107***a*, **107***b*, **109***a*, **110***a*, respectively. Therefore, the capacitors **101**, **102** can be surely soldered without using solder resist, which needs a printing process. The narrow portions **107***d*, **107***e*, **109***c*, **110***c* are formed by forming the through holes **107***f*, **107***g*, **109***d*, **110***d* in a stamping process, for example. Thus, since the narrow portions **107***d*, **107***e*, **109***c*, **110***c* can be formed in the same process as the terminals **107**, **109**, **110** are formed in the predetermined shape, additional process such as the printing process is not required. As a result, manufacturing cost can be reduced as compared to when the solder resist is used.

The narrow portions can be formed by a method other than forming the through holes. For example, as shown in FIG. **3**, narrow portions **107***i*, **109***f* are formed by forming rectangular cutout portions **107***h*, **109***e* in the wiring portions **107***c*, **109***b*, respectively.

Second Embodiment

A second embodiment of the present invention is described below with reference to FIGS. **4**A, **4**B. A difference between the first and second embodiments is that the narrow portions are replaced with wall portions.

As shown in FIGS. **4**A, **4**B, a connector terminal **107** has a soldering portion **107***a* and a wiring portion **107***c*. The wiring portion **107***c* is bent upward to form a wall portion **107***j*. The wall portion **107***j* is located adjacent to the soldering portion **107***a* and causes the wiring portion **107***c* to be located at a higher elevation than the soldering portion **107***a*. The wall portion **107***j* and the connector terminal **107** are one-piece. A terminal **109** has a soldering portion **109***a* and a wiring portion **109***b*. The wiring portion **109***b* is bent upward to form a wall portion **109***g*. The wall portion **109***g* is located adjacent to the soldering portion **109***a* and causes the wiring portion **109***b* to be located at a higher elevation than the soldering portion **109***a*. The wall portion **109***g* and the terminal **109** are one-piece. The capacitor **101** is soldered to the soldering portion **107***a* of the connector terminal **107** and the soldering portion **109***a* of the terminal **109** through solder **111**. The capacitor **102** is soldered in the same manner as the capacitor **101**.

According to the second embodiment, the wall portions **107***j*, **109***g* help prevent melted solder **111** from spreading to areas outside the soldering portions **107***a*, **109***a*, respectively. Therefore, the capacitor **101** can be surely soldered without using solder resists, which needs a printing process. The wall portions **107***j*, **109***g* are formed by bending the wiring portions **107***c*, **109***b*. Thus, since the wall portions **107***j*, **109***g* can be formed in the same process as the terminals **107**, **109** are formed in the predetermined shape, additional process such as the printing process is not required. As a result, manufacturing cost can be reduced as compared to when the solder resist is used.

Third Embodiment

A third embodiment of the present invention is described below with reference to FIGS. **5**A, **5**B. A difference between

the first and third embodiments is that the narrow portions are replaced with groove portions.

As shown in FIGS. **5**A, **5**B, a connector terminal **107** has a soldering portion **107***a* and a wiring portion **107***c*. The wiring portion **107***c* has a groove portion **107***k* that is located adjacent to the soldering portion **107***a*. A depth of the groove portion **107***k* is less than a thickness of the wiring portion **107***c*. The groove portion **107***k* and the connector terminal **107** are one-piece. A terminal **109** has a soldering portion **109***a* and a wiring portion **109***b*. The wiring portion **109***b* has a groove portion **109***h* that is located adjacent to the soldering portion **109***a*. A depth of the groove portion **109***h* is less than a thickness of the wiring portion **109***b*. The groove portion **109***h* and the terminal **109** are one-piece. The capacitor **101** is soldered to the soldering portion **107***a* of the connector terminal **107** and the soldering portion **109***a* of the terminal **109** through solder **111**. The capacitor **102** is soldered in the same manner as the capacitor **101**.

According to the third embodiment, the groove portions **107***k*, **109***h* help prevent melted solder **111** from spreading to areas outside the soldering portions **107***a*, **109***a*, respectively. Therefore, the capacitor **101** can be surely soldered without using solder resist, which needs a printing process. Since the groove portions **107***k*, **109***h* can be formed in the same process as the terminals **107**, **109** are formed in the predetermined shape, additional process such as the printing process is not required. As a result, manufacturing cost can be reduced as compared to when the solder resist is used.

Fourth Embodiment

A fourth embodiment of the present invention is described below with reference to FIGS. **6**A, **6**B. A difference between the first and fourth embodiments is that the narrow portions are replaced with plated portions.

As shown in FIGS. **6**A, **6**B, a connector terminal **107** has a soldering portion **107***a* and a wiring portion **107***c*. The wiring portion **107***c* has a plated portion **107***m* that is located adjacent to the soldering portion **107***a* and has a predetermined width. A surface of the plated portion **107***m* is plated with a material having a less solder wettability than the soldering portion **107***a*. A terminal **109** has a soldering portion **109***a* and a wiring portion **109***b*. The wiring portion **109***b* has a plated portion **109***i* that is located adjacent to the soldering portion **109***a* and has a predetermined width. A surface of the plated portion **109***i* is plated with a material having a less solder wettability than the soldering portion **109***a*. The capacitor **101** is soldered to the soldering portion **107***a* of the connector terminal **107** and the soldering portion **109***a* of the terminal **109** through solder **111**. The capacitor **102** is soldered in the same manner as the capacitor **101**.

According to the fourth embodiment, the plated portions **107***m*, **109***i* help prevent melted solder **111** from spreading to areas outside the soldering portions **107***a*, **109***a*, respectively. Therefore, the capacitor **101** can be surely soldered without using solder resist, which needs a printing process.

(Modifications)

The embodiments described above may be modified in various ways. For example, the metal wiring plate **107**, **109**, **110** can be applied to an apparatus other than an acceleration sensor apparatus.

Such changes and modifications are to be understood as being within the scope of the present invention as defined by the appended claims.

What is claimed is:

1. A metal wiring plate in combination with a housing, the combination comprising:

a soldering portion to which an electronic device is soldered; and

a wiring portion extending from the soldering portion and configured to electrically connect the electronic device to an other device,

wherein the metal wiring plate is integrally fixed to the housing;

wherein the wiring portion includes a wall portion located adjacent to the soldering portion, and

wherein the wall portion extends upward from the soldering portion along an open step portion of the housing and causes the wiring portion to be located at a higher elevation than the soldering portion.

2. The combination according to claim **1**,

wherein the wall portion is formed by bending the wiring portion.

3. The combination according to claim **1**,

wherein the wall portion is configured to prevent melted solder applied to the soldering portion from spreading to areas outside the soldering portion.

4. The combination according to claim **1**,

wherein the housing has a recess with a side wall defined by the step portion,

wherein the soldering portion is fixed to a bottom of the recess,

wherein the wiring portion is fixed to a surface of the housing around an opening of the recess,

wherein the wall portion is fixed to the side wall of the recess, and

wherein the electronic device is located in the recess, and

wherein the other electronic device is located outside the recess.

5. The combination according to claim **1**,

wherein the wall portion is exposed outside the housing.

6. The combination according to claim **1**,

wherein the soldering portion and the wiring portion are fixed directly to the housing.

7. The combination according to claim **6**,

wherein the wall portion directly engages the open step portion of the housing.

8. The combination according to claim **1**,

wherein the wall portion directly engages the open step portion of the housing.

* * * * *